CLAIMS

What is claimed is:

1. An actuator comprising an actuator element with a strain gradient variation between a first phase and a second phase.

2. The actuator as set forth in claim 1, wherein said actuator element comprises a shape memory alloy.

3. The actuator as set forth in claim 2, wherein said shape memory alloy comprises nitinol.

4. The actuator as set forth in claim 2, wherein said first state is a Martensite phase of said shape memory alloy.

5. The actuator as set forth in claim 2, wherein said second phase is an Austenite phase of said shape memory alloy.

6. The actuator as set forth in claim 1, wherein said actuator element in said first phase is positioned in a curved shape with said strain gradient variation along a cross-section of said actuator element.

7. The actuator as set forth in claim 6, wherein said actuator element in said second phase is positioned in a different curved shape when compared to said curved shape in said first phase in a direction to minimize said strain gradient.

8. The actuator as set forth in claim 1, wherein said actuator element in said first phase is positioned in an irregular shape with said strain gradient variation along a cross-section of said actuator element.

9. The actuator as set forth in claim 8, wherein said actuator element in said second phase is positioned in a different irregular shape when compared to said irregular shape in said first phase in a direction to minimize said strain gradient.

10. The actuator as set forth in claim 1, wherein said actuator element in said first phase is positioned in a non-linear shape with said strain gradient variation along a cross-section of said actuator element.

11. The actuator as set forth in claim 10, wherein said actuator element in said second phase is positioned in a different non-linear shape when compared to said non-linear shape in said first phase in a direction to minimize said strain gradient.

12. The actuator as set forth in claim 1, wherein said actuator element in said second phase is positioned in a substantially linear shape.

13. The actuator as set forth in claim 1, further comprising an activating means for said actuator element.

14. The actuator as set forth in claim 13, wherein said activating means comprises a heating means.

15. The actuator as set forth in claim 1, wherein said actuator element generates a rotary movement when transitioning from said first phase to said second phase.

16. The actuator as set forth in claim 1, wherein said actuator element generates a linear movement when transitioning from said first phase to said second phase.

17. The actuator as set forth in claim 1, wherein said actuator element generates an expanding movement when transitioning from said first phase to said second phase.

18. The actuator as set forth in claim 1, wherein said actuator element generates a combined linear and rotary movement when transitioning from said first phase to said second phase.

19. The actuator as set forth in claim 1, wherein said actuator element generates a linear movement by combining a contraction and said strain gradient.

20. A method of providing an actuator, comprising the steps of:

(a) providing an actuator element;

(b) providing a strain gradient variation between a first phase and a second phase of said actuator element; and

(c) providing an activating means to activate said actuator element and transition said actuator element from said first phase to said second phase.

21. The method as set forth in claim 20, wherein said actuator element comprises a shape memory alloy.

22. The method as set forth in claim 21, wherein said shape memory alloy comprises nitinol.

23. The method as set forth in claim 21, wherein said first state is a Martensite phase of said shape memory alloy.

24. The method as set forth in claim 21, wherein said second phase is an Austenite phase of said shape memory alloy.

25. The method as set forth in claim 20, wherein said actuator element in said first phase is positioned in a curved shape with said strain gradient variation along a cross-section of said actuator element.

26. The method as set forth in claim 25, wherein said actuator element in said second phase is positioned in a different curved shape when compared to said curved shape in said first phase in a direction to minimize said strain gradient.

27. The method as set forth in claim 20, wherein said actuator element in said first phase is positioned in an irregular shape with said strain gradient variation along a cross-section of said actuator element.

28. The method as set forth in claim 27, wherein said actuator element in said second phase is positioned in a different irregular shape when compared to said irregular shape in said first phase in a direction to minimize said strain gradient.

29. The method as set forth in claim 20, wherein said actuator element in said first phase is positioned in a non-linear shape with said strain gradient variation along a cross-section of said actuator element.

30. The method as set forth in claim 29, wherein said actuator element in said second phase is positioned in a different non-linear shape when compared to said non-linear shape in said first phase in a direction to minimize said strain gradient.

31. The method as set forth in claim 20, wherein said actuator element in said second phase is positioned in a substantially linear shape.

32. The method as set forth in claim 20, further comprising an activating means for said actuator element.

33. The method as set forth in claim 32, wherein said activating means comprises a heating means.

34. The method as set forth in claim 20, wherein said actuator element generates a rotary movement when transitioning from said first phase to said second phase.

35. The method as set forth in claim 20, wherein said actuator element generates a linear movement when transitioning from said first phase to said second phase.

36. The method as set forth in claim 20, wherein said actuator element generates an expanding movement when transitioning from said first phase to said second phase.

37. The method as set forth in claim 20, wherein said actuator element generates a combined linear and rotary movement when transitioning from said first phase to said second phase.

38. The method as set forth in claim 20, wherein said actuator element generates a linear movement by combining a contraction and said strain gradient.

39. An actuator device, comprising:

(a) a first body; and

(b) an actuator element with a first end attached to said first body, wherein said actuator element has a strain gradient variation between a first phase and a second phase.

40. The device as set forth in claim 39, further comprising a second body attached to a second end of said actuator element.

41. The device as set forth in claim 40, wherein said first body is movably attached to said second body by a connecting means.

42. The device as set forth in claim 39, further comprising a second body wherein said second body is attached to a point in between said first end and a second end of said actuator element and said second end is attached to said first body.

43. The device as set forth in claim 39, wherein said actuator element is embedded in said actuator device.

44. A method of providing an actuator device, comprising the steps of:
   (a) providing a first body;
   (b) providing an actuator element with a first end attached to said first body;
   (c) providing a strain gradient variation between a first phase and a second phase of said actuator element; and
   (d) providing an activating means to activate said actuator element and transition said actuator element from said first phase to said second phase.

45. The method as set forth in claim 44, further comprising the step of providing a second body attached to a second end of said actuator element.

46. The method as set forth in claim 45, wherein said first body is movably attached to said second body by a connecting means.

47. The method as set forth in claim 44, further comprising the step of providing a second body wherein said second body is attached between said first end and a second end of said actuator element and said second end is attached to said first body.

48. The method as set forth in claim 44, wherein said actuator element is embedded in said actuator device.